Compact, Pneumatically Actuated Filter Shuttle

This unit satisfies a special need for alternate observation in two spectral bands.

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A compact, pneumatically actuated filter shuttle has been invented to enable alternating imaging of a wind-tunnel model in two different spectral bands characteristic of the pressure and temperature responses of a pressure- and temperature-sensitive paint. This filter shuttle could also be used in other settings in which there are requirements for alternating imaging in two spectral bands. Pneumatic actuation was chosen because of a need to exert control remotely (that is, from outside the wind tunnel) and because the power leads that would be needed for electrical actuation would pose an unacceptable hazard in the wind tunnel. The entire shuttle mechanism and its housing can be built relatively inexpensively [<$500 (prices as of year 2000)] from off-the-shelf parts.

The shuttle mechanism (see Figure 1) is contained in a housing that has dimensions of 4 by 6 by 2 in. (about 10 by 15 by 5 cm). Two 2-in. (≈5-cm)-diameter standard scientific-grade band-pass filters are mounted on sliding panels in a dual-track frame. The mechanism is positioned and oriented so the panels slide sideways with respect to the optical axis of a charge-coupled-device camera used for viewing the wind-tunnel model. The mechanism includes a pneumatic actuator connected to a linkage. The linkage converts the actuator stroke to a scissorlike motion that places one filter in front of the camera and the other filter out of the way. Optoelectronic sensors detect tabs on the sliding panels for verification of the proper positioning of the filters.

The pneumatic actuator is energized by readily available shop compressed air at a pressure of 60 psi (≈0.4 MPa). The pneumatic actuator in the filter shuttle is connected via tubes to a main control unit (see Figure 2). A solenoid valve in the main control unit switches the compressed air between tubes to switch the filters. To keep the tubes and thus the switching time as short as possible, the main control unit is located as close as possible to the filter shuttle. The switching time is about half a second. The solenoid valve is actuated and controlled electrically from a station that can be located as far as 300 ft (≈90 m) from the main control unit. The switch command for the solenoid valve can be generated either manually or by a control computer.

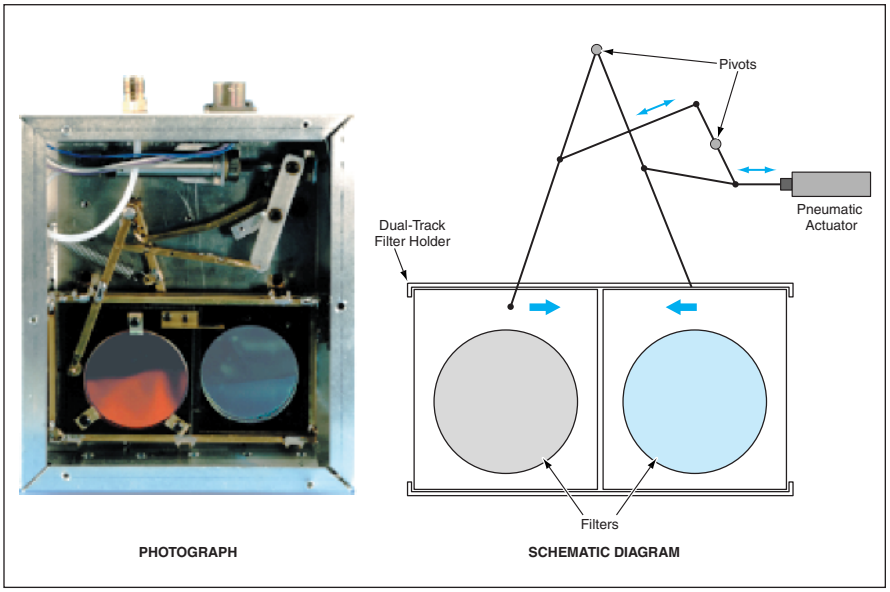

Figure 1. The **Shuttle Mechanism** interchanges the positions of two filters on command to place one and then the other in front of an electronic camera.

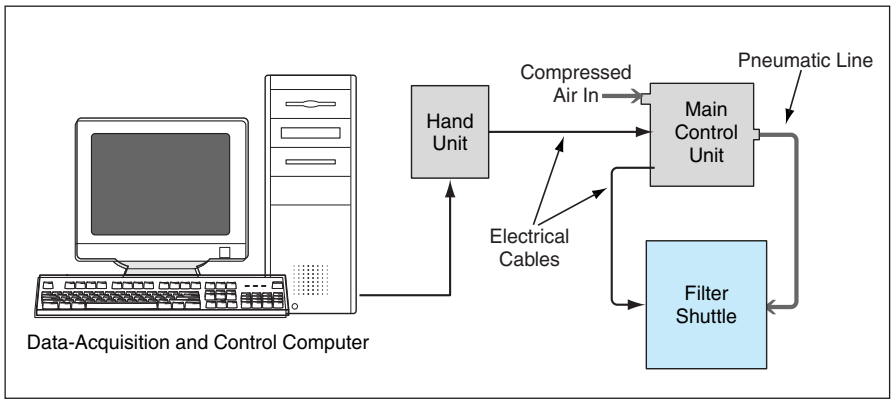

Figure 2. The **Filter Shuttle Is Part of a System** for remotely controlled observation of a model in a wind tunnel.

This work was done by Bradley D. Leighty of **Langley Research Center**. *Further information is contained in a TSP (see page 1).*
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